HALLIBURTON

Energy and Commerce Committee Staff Briefing

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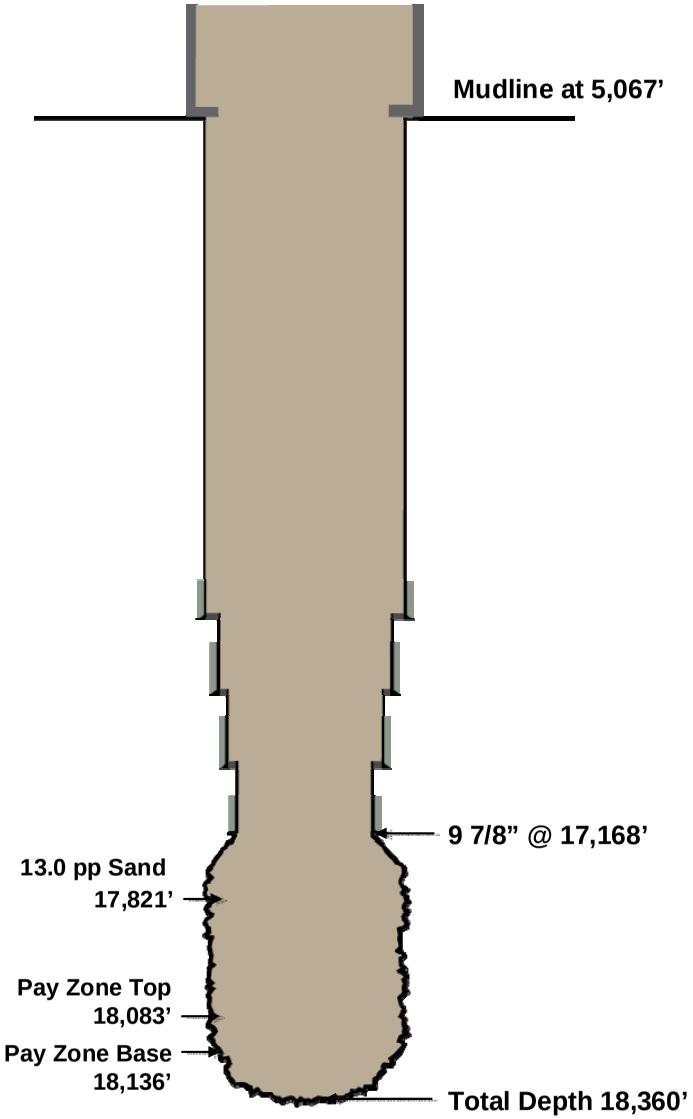
Mississippi Canyon Block 252 Well # 1-01



"Given geologic and mechanical conditions":

- 9-7/8" liner set 17,168 ft.
- Hole section drilled with 8-1/2" bit to 18,360 ft.
  - Caliper hole size range to 11.6"
- 14.0 ppg mud weight
  - Sand #1: 17,821 ft.
    - 13.0 ppg pore pressure
  - Pay Zone: 18083 ft to 18,136 ft.
    - 12.6 ppg pore pressure
- Loss Circulation events below casing shoe
- 210° F. Bottom Hole Static Temperature
  - Concerns of Annular Pressure Buildup during production

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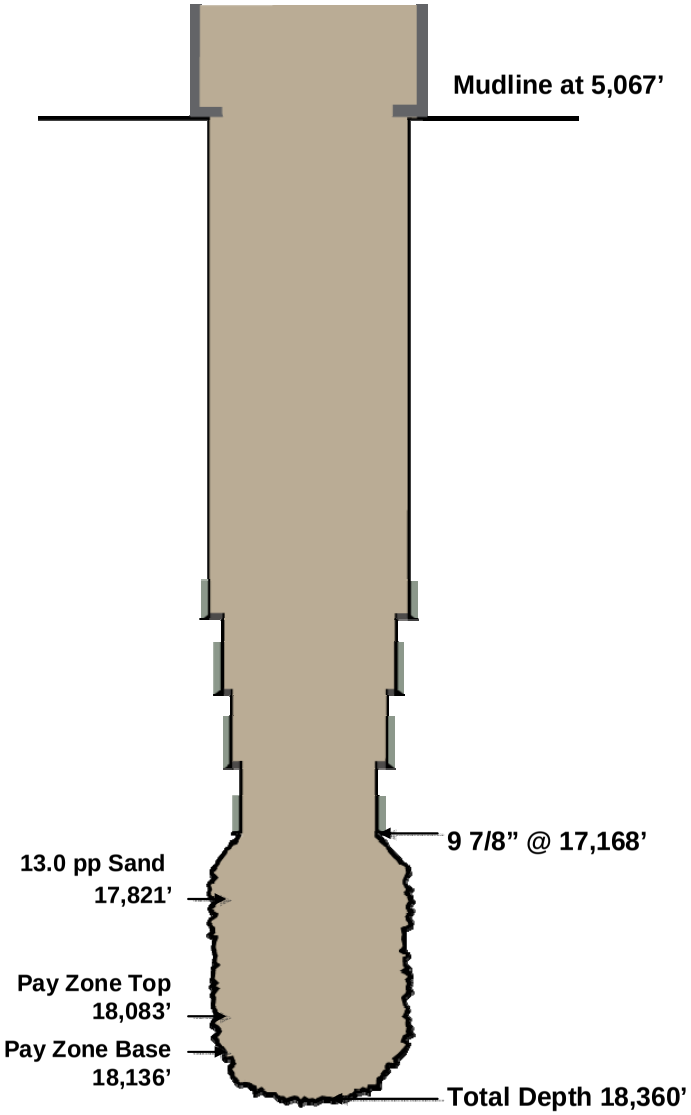
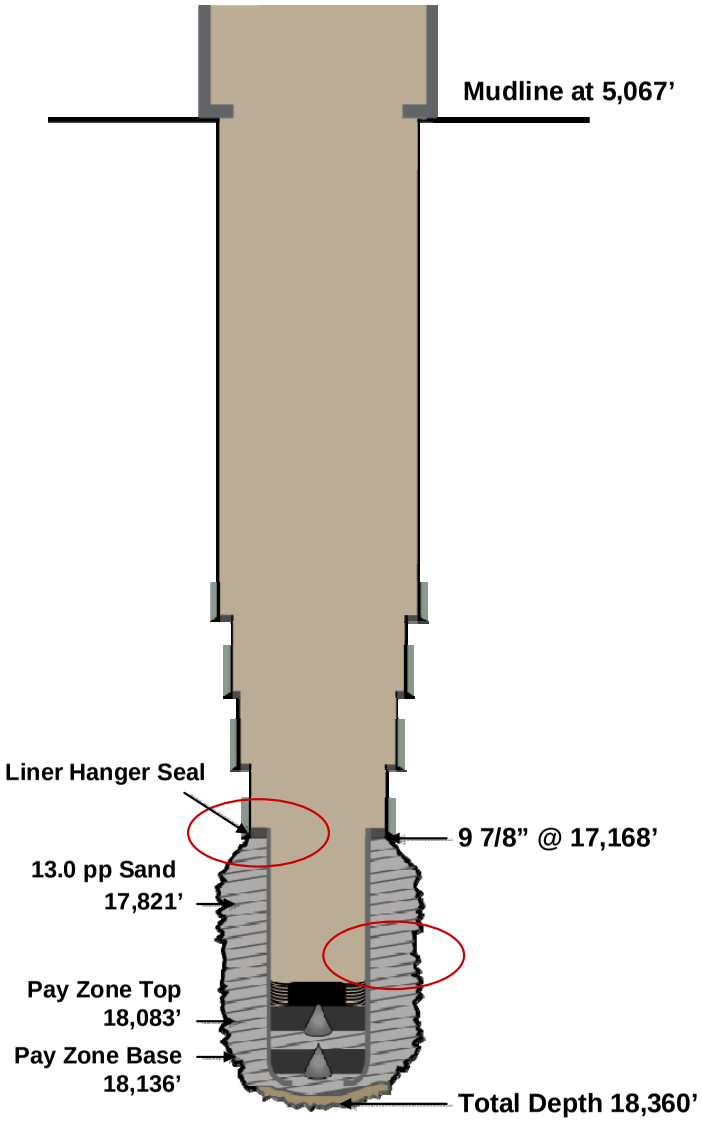
Liner/Tieback or Casing?



- **MMS: 250.421** What are the casing and cementing requirements
  - Production Casing
    - Design casing and select setting depth based on anticipated or encountered geologic characteristics or wellbore conditions
    - Use enough cement to cover or isolate all hydrocarbon bearing zones above the shoe.
    - As a minimum, you must cement the annular spacer 500 feet above the uppermost hydrocarbon-bearing zone.
- **Well Control:** "Maintain multiple effective barriers at all times"
  - Dr. F.E. Beck, Texas A&M University
    - May 11, 2010 – U.S. Senate Committee on Energy and Natural Resources

Liner



- **Challenge:** Open hole primary cement placement
  - The “given geologic and mechanical conditions” limit the techniques available for effective cement placement.
    - Primary cement sheath should be evaluated after placement
    - Remediate (squeeze cement) as required
- **Advantage:** Liner hanger seal assembly provides a mechanical barrier
- Liner provides two barriers to annular flow

Legend:
Annular barriers

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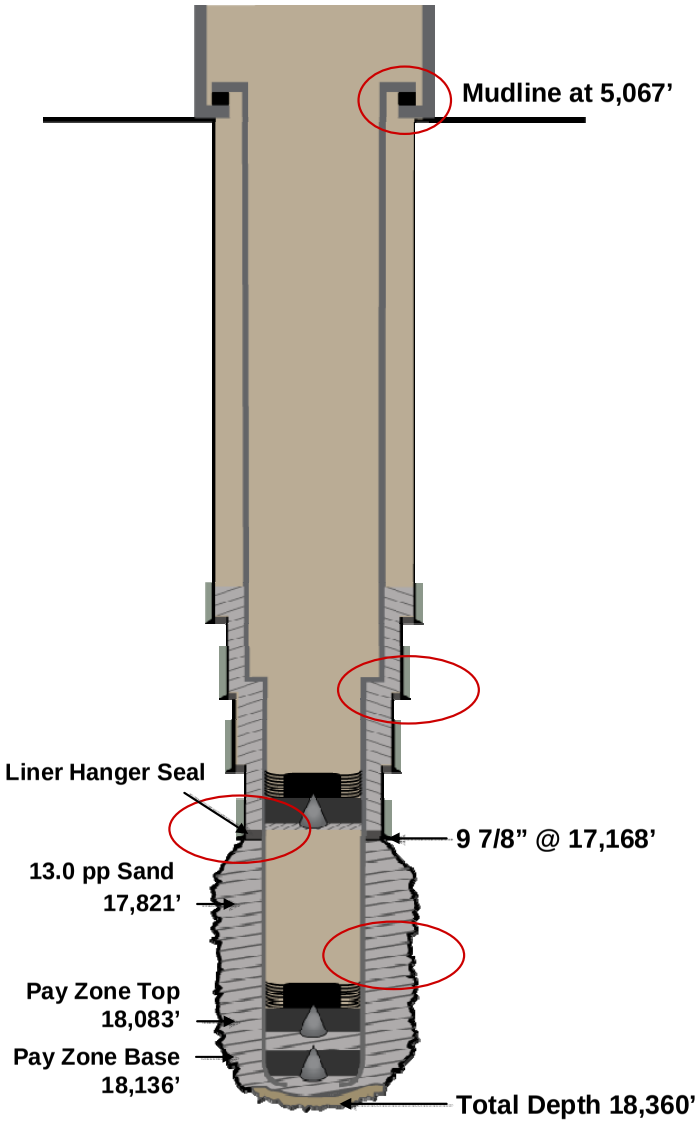
Liner/Tieback



- **Advantage:** Cased hole primary cement placement
  - Open hole geologic conditions limiting techniques for effective cementing placement are eliminated
    - Liner hanger seal isolates open hole below
  - Tieback cementing provides an effective method to place cement in casing by casing annulus
    - Tieback cementing provides enhanced opportunity for effective barrier placement
- Liner/Tieback provides four barriers to annular flow

Legend:
Annular barriers

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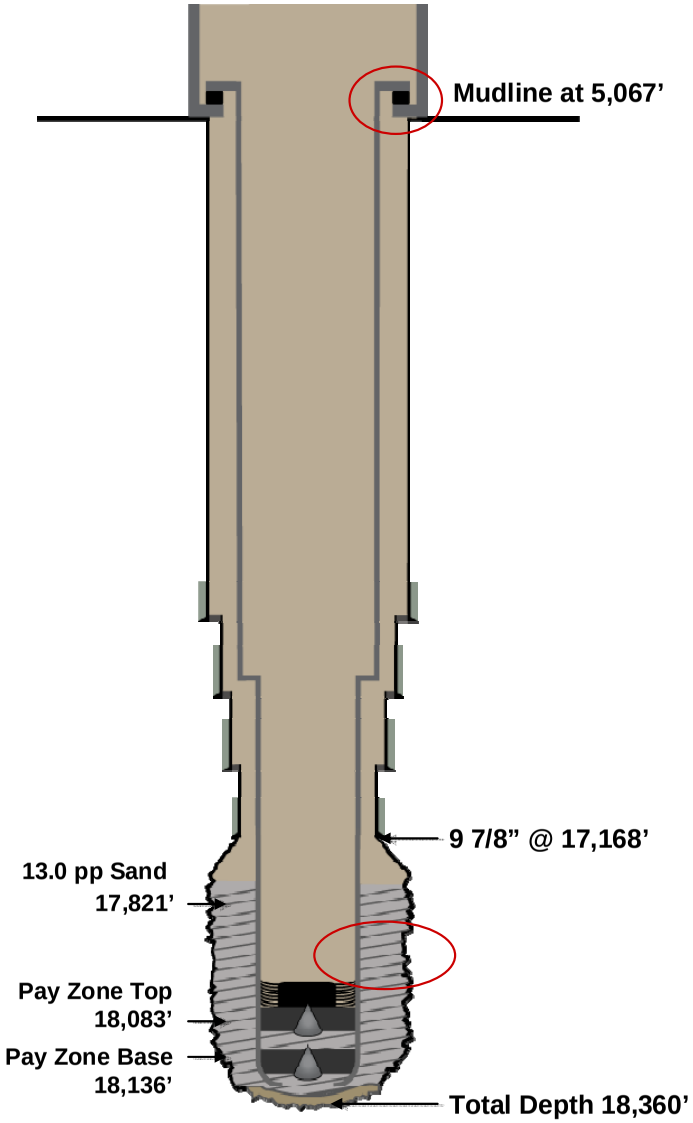
Full String Casing



- **Challenge:** Open hole primary cement placement
  - The “given geologic and mechanical conditions” limit the techniques available for effective cement placement
    - Primary cement sheath should be evaluated after placement
    - Remediate (squeeze cement) as required
- Full String Casing provides two barriers to annular flow

Legend:
Annular barriers

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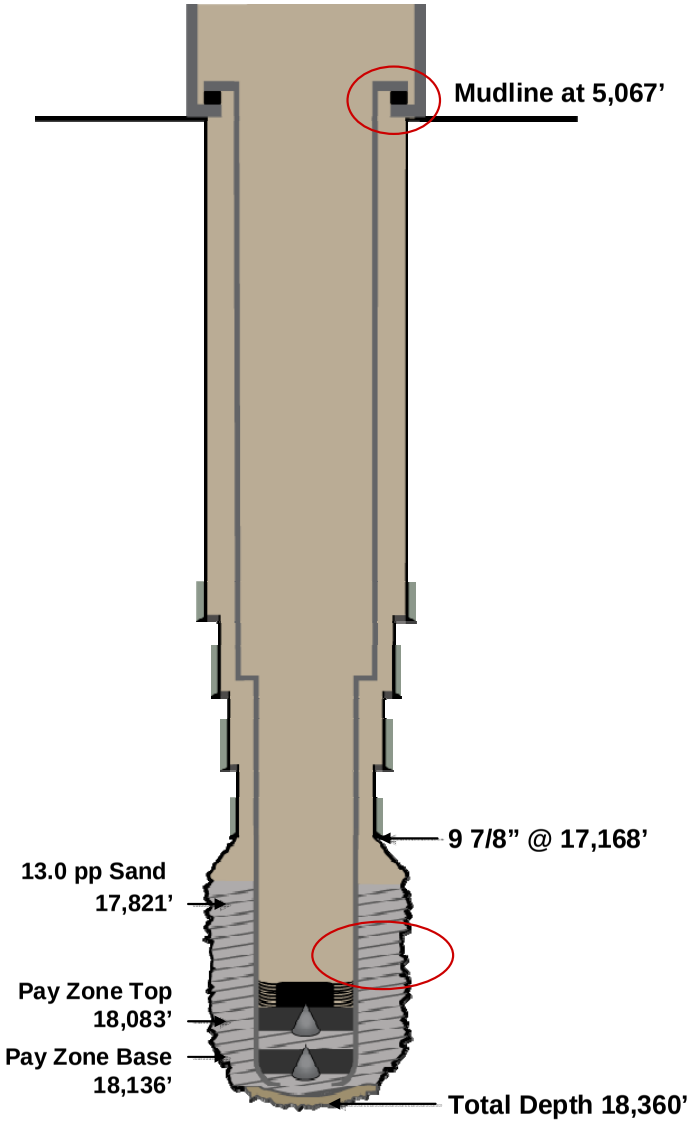
Regulatory Requirement for Cementing Evaluation



- **MMS: 250.428** What must I do in certain cementing and casing situations?
  - If you encounter the following situation:
    - Have indication of inadequate cement (such as lost returns, cement channeling, or failure of equipment)
  - Then you must:
    - Pressure test the casing shoe
    - Run a temperature survey
    - Run a cement bond log
    - Or use a combination of these techniques

Legend:
Annular barriers

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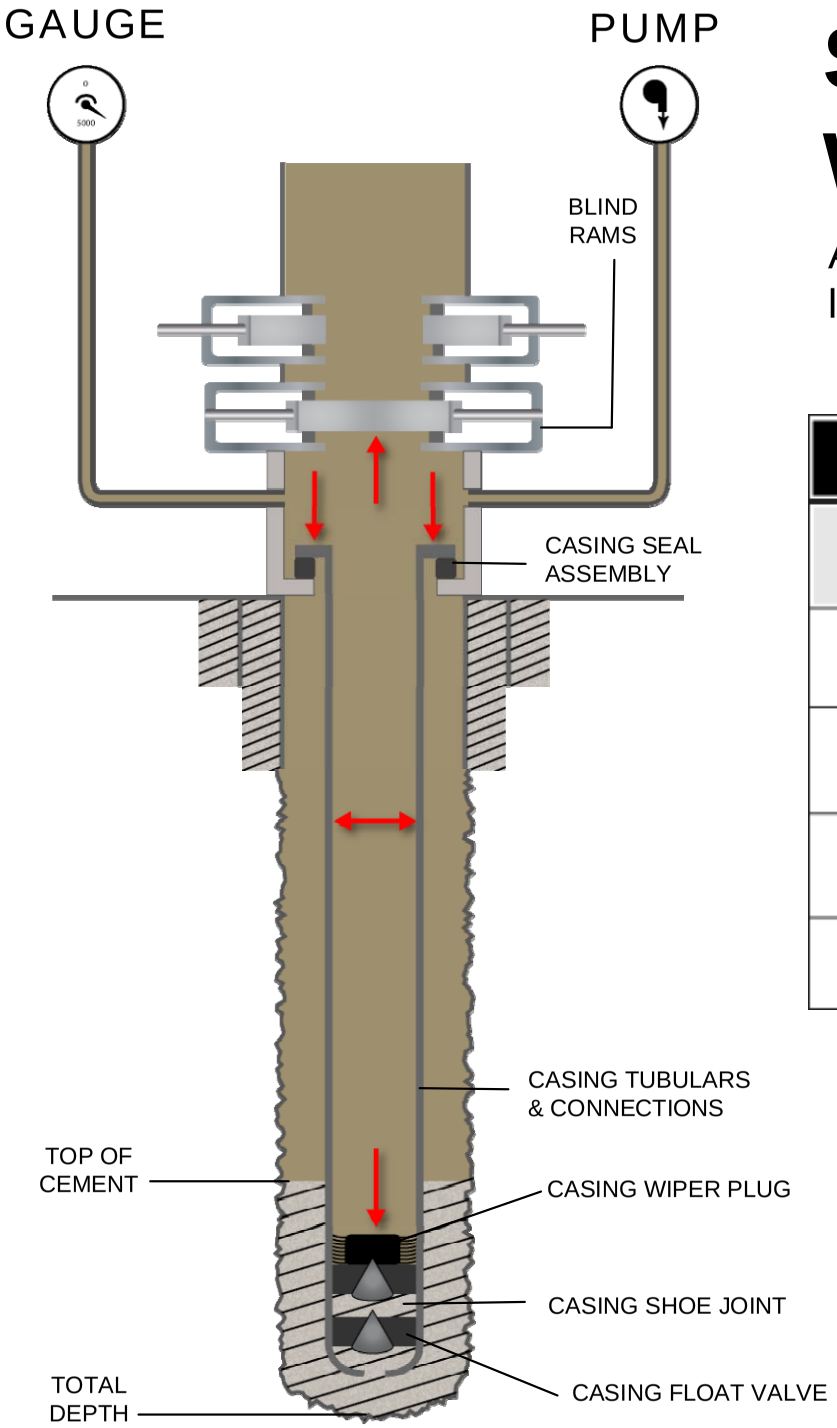

Systems Integrity Test With Positive Pressure

A successful test is realized when pressure is applied, and no loss of pressure is observed over a several minute time period.

POSITIVE PRESSURE TEST		
INDICATION OF FAILED TEST	**POTENTIAL ISSUES**	**REMEDIATION**
PRESSURE DECREASE	BLIND RAMS	REPAIR B.O.P.
PRESSURE DECREASE	CASING SEAL ASSEMBLY	REPLACE SEAL ASSEMBLY
PRESSURE DECREASE	CASING TUBULARS & CONNECTIONS	CASING PATCH
PRESSURE DECREASE	CASING WIPER PLUG/ SHOE JOINT	SQUEEZE CEMENT

Legend

: Applied Pressure
: Mud
: Cement

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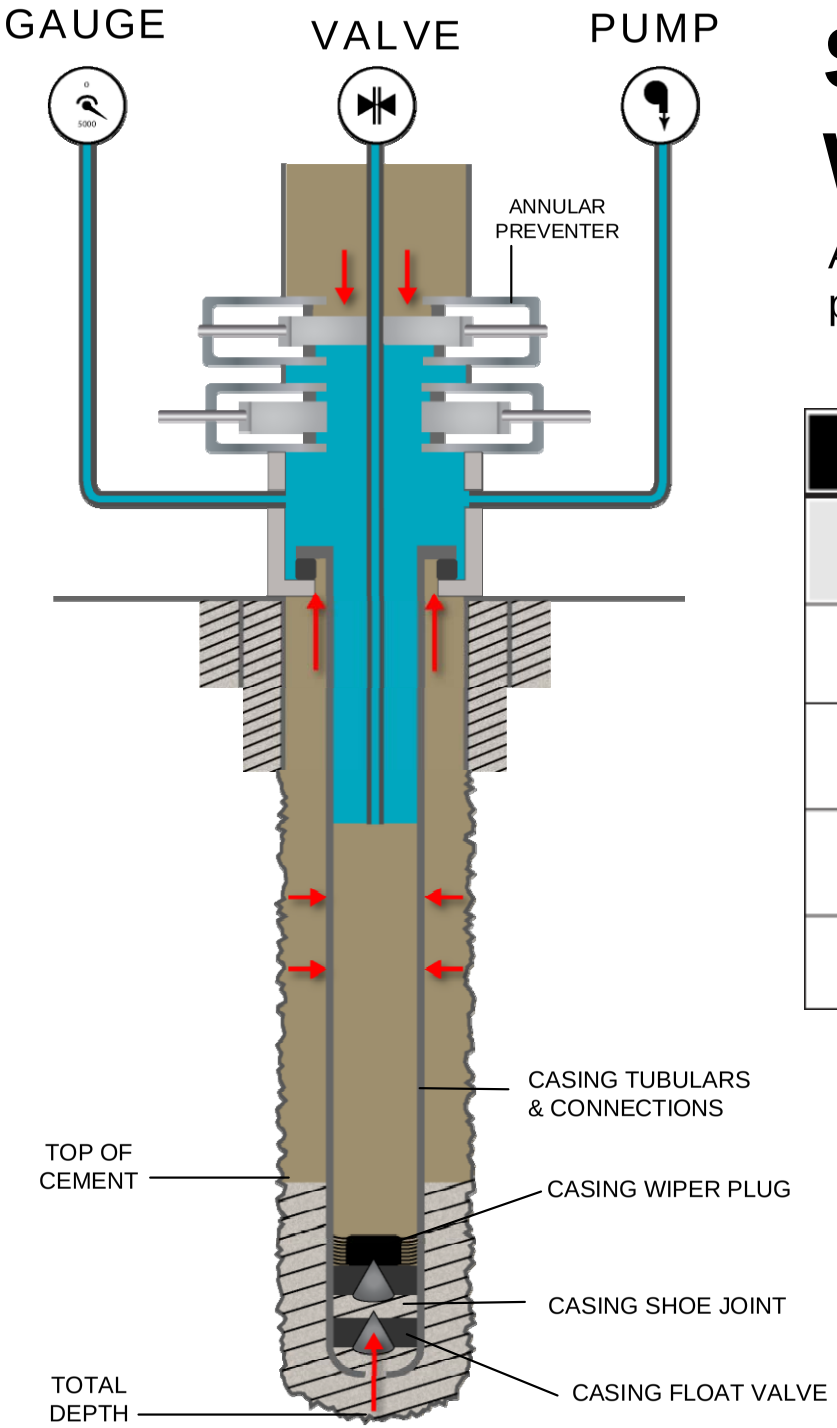

Systems Integrity Test With Negative Pressure

A successful test is realized when an applied differential pressure is released, and no flow is observed from the system.

NEGATIVE PRESSURE TEST		
INDICATION OF FAILED TEST	**POTENTIAL ISSUES**	**REMEDIATION**
POSITIVE PRESSURE AND FLOW	ANNULAR PREVENTER	REPAIR B.O.P.
POSITIVE PRESSURE AND FLOW	CASING SEAL ASSEMBLY	REPLACE SEAL ASSEMBLY
POSITIVE PRESSURE AND FLOW	CASING TUBULARS & CONNECTIONS	CASING PATCH
POSITIVE PRESSURE AND FLOW	CASING FLOAT VALVES/SHOE JOINT	SQUEEZE CEMENT

Legend

: Applied Pressure
: Sea Water
: Mud
: Cement

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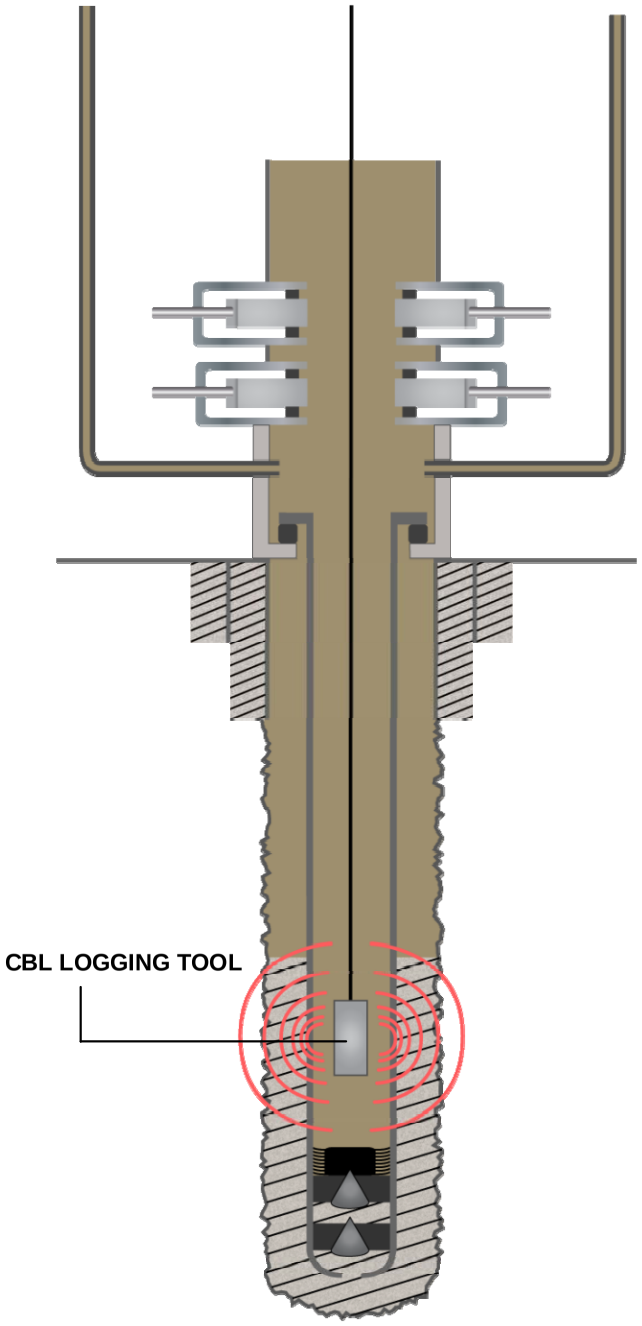
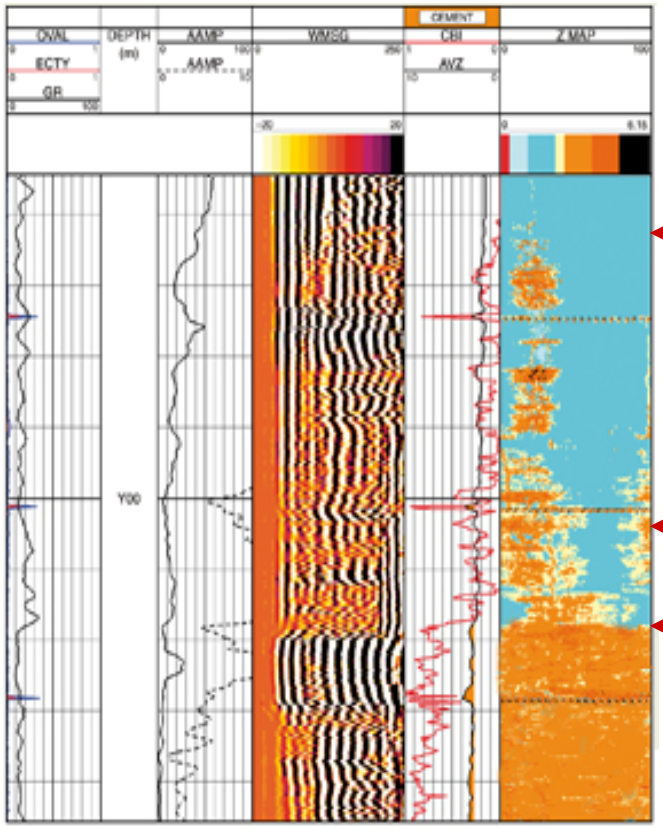
Cement Evaluation

Cement Bond Logs





No Cement Bond

Channel in Cement

Top of Cement

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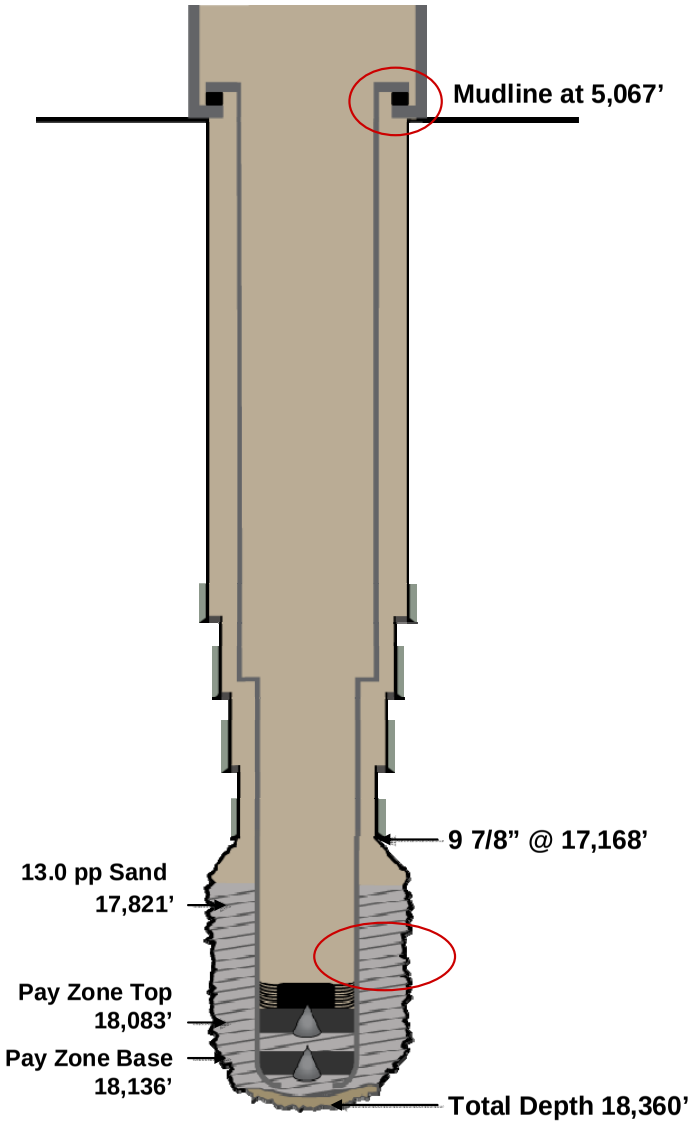
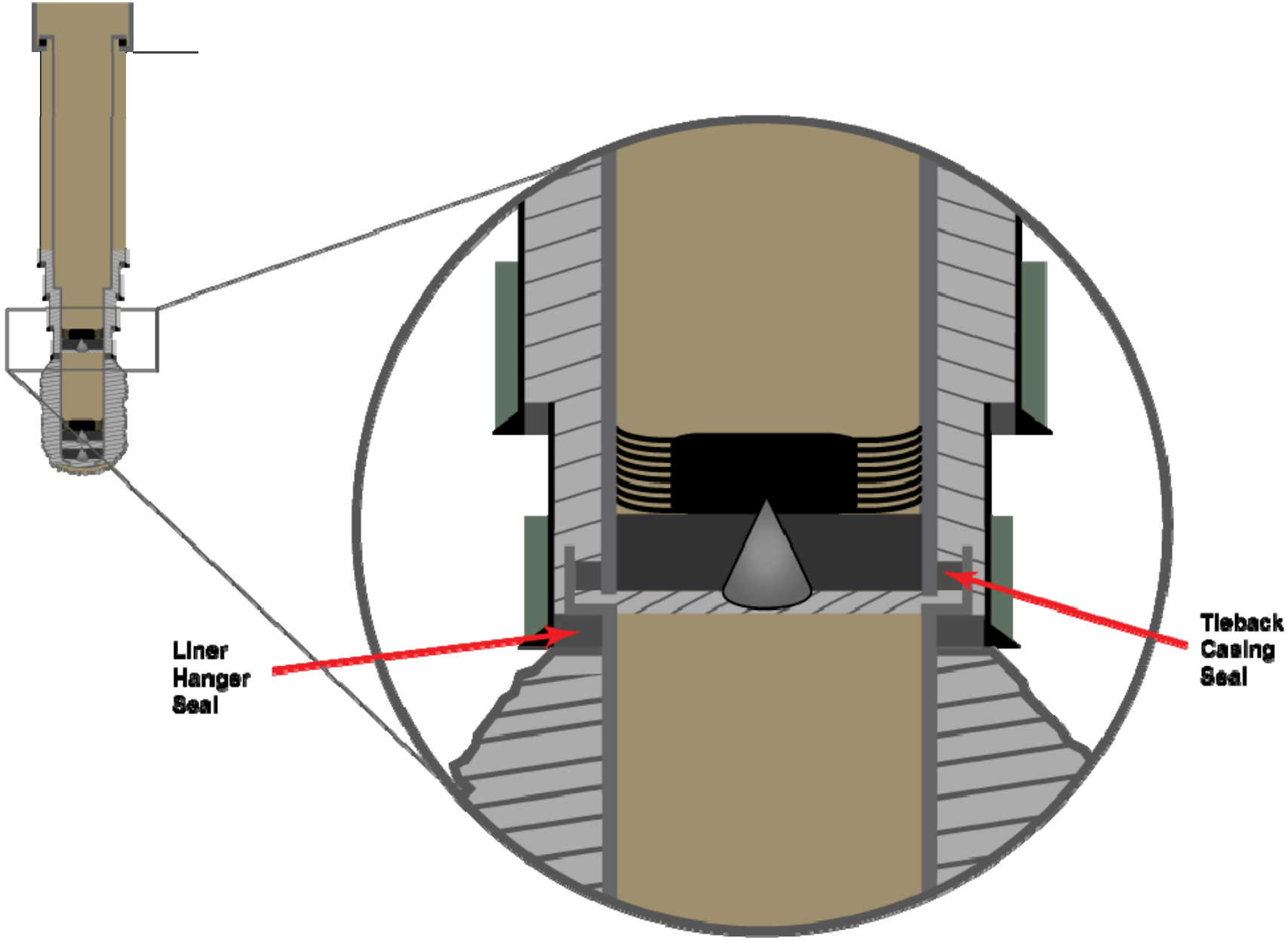
Summary



- Full String Casing provides two barriers to annular flow
- Liner/Tieback Casing provides advantage over full string casing with redundant barriers to annular flow
- If the cement is to be relied upon as an effective barrier, the well owner must perform a cement evaluation as part of a comprehensive systems integrity test

Appendix



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